

# Reform, competition and risk-taking in banking: Evidence from Central and Eastern European countries

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## Abstract

The aim of this study is to examine the relationship between reform, competition and risk-taking in banking. The transition from centrally planned to a market economy in Central and Eastern Europe (CEE) offers a unique natural experiment for the study of this relationship. Using direct measures of competition and banking-sector reform and both static and dynamic empirical frameworks, we identify a robust positive relationship between competition and bank risk-taking, which is however not necessarily associated with changes in the institutional environment. The latter effect claims legitimacy as competition in CEE banks has not improved, at least during the examined 1994-2005 period.

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## **Abstract**

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## **1. Introduction**

As we learn more about the dynamics of financial stability, three interrelated determinants of bank performance are receiving increasing attention by scholars and policy makers, namely bank risk-taking, competition and banking sector reform. The relationship between these three factors (RCR hereafter) is nurtured in an important paper by Keeley (1990), who argued that deregulation of the US banking sector in the 1970s and 1980s increased competition and, through the associated reduction in monopoly rents, led to a worsened equilibrium risk of failure. The possible trade-off between competition and risk-taking in banking has ever since been examined by a number of researchers both theoretically and empirically, however the results may be better described as mixed. Inasmuch as this literature is seminal to our perception of the RCR nexus, we feel that it may be augmented in two main directions. First, most studies examine banking systems of OECD countries and related regulatory policies, while evidence derived from transition economies is scant. Second, the empirical investigation seems to be constrained by the measures used to proxy the reform process and the competitive conditions in banking.

This paper aims to add to the RCR debate by building on these two insights. In particular, we consider the case of Central and Eastern European (CEE) countries. The rapid transition of these countries from centrally planned to market economies and the quite uniform institutional, structural and managerial transformation that characterized them in the past fifteen years, offers a unique natural experiment to document and quantify the strength of the links in the RCR chain. As such, it seems that a more appropriate term that encompasses the full set of developments in the CEE banking environment is “bank reform.” Rather than merely deregulation, the effect of bank reform on competition and risk-taking is central to the present analysis.

To this point there has been little systematic work on measuring the competitive conditions in CEE banking systems, and most of previous literature resorts to concentration indices (structural measures). This paper aims to fill this gap by developing extensive new non-structural indices of bank competition for 13 CEE banking systems over the period 1994-2005, which are subsequently used in the examination of the RCR nexus. Also, this study employs the important research output of the European Bank of Reconstruction and Development (EBRD) to quantify the reform process in CEE banking, and it identifies all the relevant banking laws that facilitated the transition, categorizing these laws on the basis of their effect on different types of bank risk. Pertinent to the extensive and rapid restructuring, the static econometric frameworks may be insufficient to capture the dynamics of the reform and therefore we additionally employ a dynamic empirical model. Finally, statistical robustness is ensured by extensive misspecification tests and respecifications of the empirical frameworks.

The rest of the paper is organized as follows. Section 2 reviews the related literature and illustrates its influence on policy makers. Section 3 specifies the empirical model and describes the CEE banking industry structure. Section 4 presents the estimation methods and the empirical results. Section 5 concludes the paper.

## **2. Brief literature review**

In an important contribution, Keeley (1990) provided both a theoretical framework and empirical evidence that deregulation of the US banking sector led to erosion of bank market power and consequently of the market value of their equity capital. In turn, this increased the incentive of banks to take on extra risk, thus also increasing the risk of failure. Keeley's paper triggered a lively discussion of the

channels through which bank performance, and hence the stability of the banking system, is affected following deregulation measures.

Matutes and Vives (2000) analyze the relation between competition for deposits and risk-taking incentives and conclude that the welfare performance of the market and the appropriateness of alternative regulatory measures depend on the degree of rivalry and the deposit insurance regime. They find that deposit insurance tends to make banks more aggressive competitors and induces them to undertake maximal asset risk positions. In a dynamic framework, Bolt and Tieman (2004) reached similar conclusions by examining the asset side of a bank's balance sheet. In particular, they show that more stringent capital adequacy requirements lead banks to set stricter acceptance criteria for granting loans, while increased competition in the banking industry leads to riskier bank behavior.

However, more recent papers advocate that the relationship between competition and financial stability may in fact be nonnegative. Allen and Gale (2004), studying a variety of models, suggest a complex and multi-faceted link based on the modeling framework followed. Boyd and de Nicolo (2005) show that as competition declines banks earn more rents in their loan markets by charging higher loan rates, which however imply higher bankruptcy risk for borrowers. Then, within a moral hazard framework, borrowers optimally increase their own risk of failure, which naturally leads to financial instability. Boyd et al. (2006) examined two theoretical models, the first pointing to a negative correlation between banks' risk of failure and competition, and the second establishing the opposite result. The fact that the second model was verified empirically on the basis of large US and international samples, implies that increased competition does not lead to unstable banking environments.

Apart from Keeley (1990), the empirical literature on the relationship between deregulation, competition and risk-taking in banking is rather limited, mainly owing to difficulties in measuring the evolution of competitive conditions and the deregulation process. Deregulation is directly measured by Salas and Saurina (2003), who employ dummy variables that correspond to important deregulation laws. Using data on Spanish banks for a 31-year period they found that deregulation measures increased competition and eroded banks' market power. On the other hand, most studies, including Boyd et al. (2006), proxy competition by structural indicators (such as concentration ratios or the Herfindahl index) that in many aspects were proved to be poor measures of competition.

Claessens and Laeven (2004) and Yildirim and Philippatos (2007) derive country-specific Panzar and Rosse H-statistics to measure competition, which they subsequently regress on a number of explanatory variables using cross-sectional estimation methods. They observe that deregulation and the opening up of the financial markets for foreign participation serve as important catalysts to increase the competitiveness of banking markets. However, some authors suggest that the H-statistic does not map as robustly into a range of oligopoly solution concepts as the Lerner index, while it does not describe the evolution of bank competition during the reform process if point estimates are derived from a panel of data (see Shaffer, 2004). Angelini and Cetorelli (2003) estimate Lerner indexes for each year of their sample period (Italian banks over the 1984-1997 period), which are also regressed on a number of explanatory variables – not including bank risk – in a second stage of analysis, again using cross-sectional methods. They find that competitive conditions, relatively unchanged until 1992, have improved substantially thereafter. Their evidence is consistent with the hypothesis that the deregulation process, which

culminated with the implementation of the Second Banking Directive in 1993, significantly contributed to improving bank competition. Finally, Chen (2007) examines the effect of banking deregulation on credit risk using a sample of European banks and concludes that deregulation improves loan quality and leads to lower credit risk. Yet, the focus of this paper is merely on credit risk, while competition is proxied by structural indexes and by the H-statistic.

Overall, the existing literature of the RCR nexus is mainly concerned with developed banking systems and associated regulation policies. Furthermore, to our knowledge there exists no systematic work on directly measuring *both* the regulatory reforms (i.e. review the relevant laws implemented) *and* the competitive conditions (using non-structural measures to characterize the evolution of competitive conditions). This paper, aims to address these issues in the context of a suitable empirical model, using data from the rapidly reforming CEE banking systems.

### **3. Empirical specification**

Given the considerations of the theoretical and empirical literature described above, we proceed into two steps. First, we specify an empirical model to examine the effect of banking sector reform on the level of competition and subsequently we examine the effect of both the reform process and competition on the risk-taking behavior of banks. In this way, we are able to identify a chain of causality, the first link being the restructuring initiatives in terms of either the regulatory events or the non-structural process itself, and the last link being risk-taking at the bank level.

#### *3.1. Banking sector reform and competition*

The first equation intended to examine the relationship between reform in the CEE banking systems and competition is specified as follows:

$$\theta_t = a_0 + a_1 ref_t + a_3 x_{it} + a_4 m_t + u_{it} \quad (1)$$

where banking industry competition  $\theta$  at year  $t$  is written as a function of time-dependent banking sector reform,  $ref$ ; a vector of bank-level variables reflecting the characteristics of each bank,  $x$ ; variables that capture the macroeconomic conditions common to all banks,  $m$ ; and the error term  $u$ . As discussed above, we opt for a non-structural measure of bank competition that shows how competitive conditions evolve over time and measures for  $ref$  that provide explicit proxies of the reform process.

### 3.1.1. Measuring bank competition

To measure the evolution of competitive conditions in the CEE banking systems over time, we use the methodology suggested by Uchida and Tsutsui (2005).<sup>1</sup> In particular, we jointly estimate the following system of three equations that correspond to a translog cost function, to a revenue equation obtained from the profit maximization problem of banks, and to an inverse loan demand function:

$$\begin{aligned} \ln C_{it} &= b_0 + b_1 \overline{\ln q_{it}} + \frac{1}{2} b_2 (\overline{\ln q_{it}})^2 + b_3 \overline{\ln d_{it}} + \frac{1}{2} b_4 (\overline{\ln d_{it}})^2 + b_5 \overline{\ln w_{it}} + \frac{1}{2} b_6 (\overline{\ln w_{it}})^2 + \\ &\quad b_7 (\overline{\ln q_{it}})(\overline{\ln w_{it}}) + b_8 (\overline{\ln q_{it}})(\overline{\ln d_{it}}) + b_9 (\overline{\ln d_{it}})(\overline{\ln w_{it}}) + e_{it}^C \\ R_{it} &= \frac{\theta_t}{\eta_t} R_{it} + r_{it} q_{it} + c_{it} (b_1 + b_2 \overline{\ln q_{it}} + b_7 \overline{\ln w_{it}} + b_8 \overline{\ln d_{it}}) + \\ C_{it} &\frac{q_{it}}{d_{it}} (b_3 + b_4 \overline{\ln d_{it}} + b_8 \overline{\ln q_{it}} + b_9 \overline{\ln w_{it}}) + e_{it}^s \end{aligned} \quad (2)$$

$$\ln p_{it} = g_0 - (1/\eta_t) \ln q_{it} + g_1 \ln gdp_{it} + g_2 \ln ir_t + e_{it}^D$$

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<sup>1</sup> The discussion that follows is based on Uchida and Tsutsui (2005) and briefly states the main lines of their procedure.



where  $C$  is the total cost of bank  $i$  at time  $t$ ,  $q$  is bank output,  $d$  are deposits,  $w$  are the prices of inputs,  $R$  is bank revenue,  $r$  is the interest rate on deposits,  $p$  is the price of bank output, and  $e$  are the error terms. Variables with bars represent deviations from their cross sectional means at each time period, so as to remove their trend. The variables  $gdp$  and  $ir$  are exogenous variables that affect demand. The degree of competition in each year is given by  $\theta$ , which represents the well-known conjectural variations elasticity of total industry output with respect to the output of the  $i$ th bank.

The range of possible values of  $\theta$  is given by  $[0, 1]$ . In the special case of Cournot competition,  $\theta_{it}$  is simply the output share of the  $i$ th bank at each point in time. In the case of perfect competition,  $\theta_{it} = 0$ ; under pure monopoly,  $\theta_{it} = 1$ ; and, finally,  $\theta_{it} < 0$ , implies pricing below marginal cost and could result, for example, from a non-optimizing behavior of banks. Note that in System (2) we dropped the subscript  $i$  on  $\theta$  in order to capture the industry average degree of competition (on this point see also Bresnahan, 1989). Both  $\theta$  and  $\eta$ , the latter representing the market demand elasticity for bank output, are parameters to be estimated. To estimate  $\theta$  we use year dummy variables, while to estimate  $\eta$  we use dummy variables for every two years.<sup>2</sup> A merit of this estimation method is that it provides a new yearly index of industry market power to be used in the subsequent analysis. As discussed above, previous studies have resorted to either using structural measures of competition, or non-structural measures of competition with a cross-sectional dimension.

Data for the bank-level variables are taken from BankScope, and data for the control variables are taken from the EBRD's Transition Reports and the World Bank's World Development Indicators (WDI). Specifically,  $C$  is proxied by total expenses,  $q$  by total earning assets,  $d$  by total deposits and short-term funding,  $w$  by

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<sup>2</sup> To estimate  $\eta$  we cannot use year dummy variables because they are linearly dependent with the time-specific control variables in the third equation of System (2).

the ratio of total operating expenses (overheads) to total assets,  $R$  by total revenue,  $r$  by the ratio of interest expenses to total deposits and short-term funding,  $p$  by the ratio of total revenue to total earning assets,  $gdp_g$  by the annual % GDP growth rate, and  $ir$  by a short-term interest rate.<sup>3</sup> Table 1 contains these variables, along with some descriptive statistics.

[Insert Table 1 here]

[Insert Table 2 here]

Estimation is carried out for each country separately using seemingly unrelated regression. The full set of  $\theta_i$  results are presented in Table 2.<sup>4</sup> The country- and year-specific estimates derived correspond to  $\theta_i$  in Eq. (1). The picture presented by the estimates is mixed, with some countries reflecting fairly competitive practices (e.g. Bulgaria and Romania), other reflecting anticompetitive behavior (Lithuania and Slovenia), and most lying in between. Changing patterns over time are also different on a country by country basis. For example, Latvia moves towards more anticompetitive industry structure, while Slovakia towards the opposite direction. Overall, the results do not suggest a transformation *en route* for more competitive banking sectors, as traditional theory suggests.<sup>5</sup> To this end, we now turn to the discussion of the determinants of bank competition.

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<sup>3</sup> The short-term interest rates used vary between countries (e.g. for some countries we use the interbank rate, for others the central bank rate etc.) because there is no uniform short-term rate reported. Since estimation is carried out for each country separately this is not a potential problem.

<sup>4</sup> Several robustness checks were performed (e.g. estimation using three-stage least squares and different specifications of inputs and outputs), however the results remained unchanged at the 5% level of significance. In particular, we used three-stage least squares, we included risk and ownership variables (public vs. private, foreign vs. domestic) among bank inputs in the cost and revenue equations and we trimmed the 5% outliers of the samples. All these results are available upon request.

<sup>5</sup> Of course most of the theoretical literature discussed in the previous section is concerned with the effect of deregulation on competition (and this within western-type banking environments) and not with the effect of reform as a whole.

### *3.1.2. Banking sector reform in the CEE countries and other determinants of competition*

Banking system restructuring was quite profound over the last decade in most CEE countries. Since the mid 1990s their banking systems were extensively reformed through the abolition of administrative interventions and regulations, which seriously hampered its development. The reforms were adopted gradually and supported the further improvement of the institutional framework and the more competent functioning of banks and financial markets in general, also in light of the CEE countries' participation in the EU. Acknowledging these, individual banks tried to strengthen their position in the domestic market, partly through M&As that would allow them to exploit economies of scale and have easier access to international financial markets.

Banks operating in the CEE region are gradually reaching the standards of their counterparts in the rest of the EU countries. The institutional reforms briefly described above have been viewed as a means to reduce bank costs, particularly those associated with risk management and the evaluation of credit information. However, for smaller and private domestic banks, risk management techniques need to improve further (see EBRD, 2006). In fact, lending in emerging markets is greatly influenced by how banks perceive the legal environment, as well as the level of hedging against risks that this environment provides. Institutional improvements, such as effective systems for taking collateral and repossessing assets in cases of default, will play a fundamental role in the further development of the CEE banking sector. On the

whole, and given the restructuring that took place in the last decade, the CEE region provides an excellent case for the study of the RCR relationship in banking.<sup>6</sup>

To examine the impact of banking sector reform on bank competition we use either dummy variables that correspond to important changes in the regulatory frameworks or the EBRD index of banking sector reform. Table 3 presents the important banking laws in the countries considered, used to form the dummy variables.<sup>7</sup> These include the fundamental ‘banking laws’ passed in each country during the sample period that characterize the organization and function of each country’s central bank and encompass *inter alia* regulation on licensing, bank supervision, and the requirements on funds, reserves and capital.

[Insert Table 3 here]

We assume that changes in the regulatory regime remain over time, and as such the (time-specific) dummies take a value of one at the year of the implementation of the relevant law and remain equal to one until the end of the sample period. Obviously, the reform process when treated like this is viewed as an ongoing process that affects banks not only at the year of change in the regulatory regime, but for all the succeeding years of the sample period (see Salas and Saurina, 2003). The EBRD index of banking sector reform has been compiled with the primary purpose of assessing the progress of the banking sectors of formally centrally planned economies. As this indicator quantifies and qualifies the degree of liberalization of the banking industry, it is suitable for an explicit evaluation of the effect of banking sector reform on the performance of banks. The reform scores of *ebrd* range from 1.0 to 4.0+, with 1.0 indicating a rigid centralized economy and 4.0+ implying the highest level of

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<sup>6</sup> For a detailed review of the reform process in the CEE countries’ financial sectors see various issues of the EBRD Transition reports (e.g. Transition report 2006: Finance in transition).

<sup>7</sup> Note that as determinants of bank competition we only used this principal banking laws. The rest of the bylaws presented in Table 3 are to be used as determinants of bank risk.

reform, which corresponds to a fully industrialized market economy. The upward trend of the index reflects the extensive restructuring that took place in the CEE banking sector during the sample period.

Finally, following the literature, the empirical analysis includes bank-level variables that reflect individual strategies of banks ( $x$ ), and macroeconomic country-specific variables ( $m$ ) that reflect the effect of the economic environment in each country. The former variables include the loan to asset and the deposit to asset ratios (taken from BankScope). The latter include the ratio of total investments over GDP as a proxy for the fluctuations in economic activity, and a short-term interest rate, which serves as a substitute for bank lending and as a proxy for interest rate risk. These variables are taken from the EBRD and the WDI.<sup>8</sup> In addition to the macroeconomic variables, we also use foreign (*for*) and public (*pub*) ownership as potential determinants of bank competition. Claessens and Laeven (2004) and Yildirim and Philippatos (2007) suggest that the nature of ownership matters for competition, and specifically that foreign bank ownership improves the level of competition. In particular, the long-term commitment of foreign banks in the markets they enter motivates them to take an active part in the enterprise decision making process and press the country's government for a more transparent and efficient business environment. This may also allow domestic banks to increase their gross fixed capital formation, expand and/or become more efficient through privatizations and M&As.

### 3.3. *Bank risk-taking*

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<sup>8</sup> A rise in investments is normally associated with higher profits for banks that may be the result of increased market power, especially if barriers to enter are present. The effect of the interest rate on  $\theta$  is an empirical issue and probably depends on the transitional dynamics of our sample. Studies of more developed banking systems suggest that higher interest rates are usually associated with higher interest rate margins, which have been shown to be positively correlated with non-structural measures of market power (see e.g. Maudos and de Guevara, 2004).

To examine the behavior of all the links in the RCR chain we opt for the following empirical specification:

$$r_{it} = b_0 + b_1\theta_t + b_2der_t + b_3x_{it} + b_4m_t + \varepsilon_{it} \quad (3)$$

The effect of risk in the second-stage regressions is captured by differentiating between the two most important types of bank risk, namely leverage (*cap*) and credit risk (*cr*). Poor asset quality (increased credit risk) and low levels of liquidity are the two major causes of bank failures. During periods of increased uncertainty, financial institutions may decide to diversify their portfolios and/or raise their liquid holdings in order to reduce their risk. Banks would therefore improve their performance by improving screening and monitoring of credit risk, with such policies involving the forecasting of future levels of risk.<sup>9</sup> Following the empirical literature, we use the ratio of loan loss provisions to total loans to measure credit risk,<sup>10</sup> and the ratio of total equity to total assets to proxy capital. The investigation of the RCR nexus through loan loss provisions has the additional virtue that this variable tends to be procyclical, and therefore it may signal lower future earnings and/or market power. As such,  $\theta$  enters the estimated equations lagged once when *cr* is the dependent variable (on this point see also Keeley, 1990; Salas and Saurina, 2003). Table 1 reports all the bank-level risk variables used, along with some descriptive statistics, which reflect gradual convergence with European practice. In particular, both ratios

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<sup>9</sup> Most studies find a negative relationship between credit risk and performance measures (e.g. Athanasoglou et al., forthcoming). As regards the capital-performance relationship, Berger (1995) suggests a positive correlation, which is mainly due to market imperfections.

<sup>10</sup> It may have been better to use as a proxy for credit risk a measure of non-performing loans instead of loan-loss provisions, since the latter may be subject to income smoothing (see Laeven and Majnoni, 2003). Unfortunately, this measure is unavailable from Bankscope and therefore we resort to the second-best solution.

steadily decline, even though they are still far-off the quality levels proposed by CAMEL analysis (5-8% for *cap* and below 1% for *cr*).<sup>11</sup>

As regards the explanatory variables,  $\theta$  is the level of competition derived above, *der* are dummy variables (zero up to year t-1, one from year t onwards) that capture regulatory changes related to capital and credit risk, *x* are bank-specific variables and *m* are macroeconomic control variables. The regulatory events affecting capital and credit risk are given in Table 3. The dummies here are formed on the basis of the principal banking laws for both *cap* and *cr* in addition to the separate bylaws that concern one of the two risk measures as indicated in Table 3. The rest of the explanatory variables in Eq. (3) are identical with those of Eq. (1). We expect the relationship between  $\theta$  and *cap* to be positive, whereas the respective relationship between  $\theta$  and *cr* is expected to be negative (Keeley, 1990; Salas and Saurina, 2003).

#### **4. Estimation and results**

In this section, we investigate whether banking sector reform (i) affects the degree of banking industry competition, and (ii) is channeled, through competition, to increased risk-taking behavior of banks. As discussed above, the first question refers to estimation of Eq. (1) and the second to estimation of Eq. (3). Here we opt for both static and dynamic specifications of these empirical models. The static specifications are the norm in the literature and refer to the estimation of Eqs. (1) and (3). Yet, Berger et al. (2000), among others, have shown that even a developed banking industry, such as that of the US, is subject to impediments that yield various forms of persistence in bank-level rents. One of these impediments refers to the level of

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<sup>11</sup> CAMEL analysis provides a framework for the evaluation of banks through the complete coverage of the factors affecting bank creditworthiness. It has emerged as the industry standard. The factors covered in this framework are capital adequacy, asset quality, management, earnings and liquidity. In a nutshell, the acronym to remember is CAMEL.

competition, which is of particular interest in the present analysis. As our market power estimates suggest, changes in competitive conditions in the banking sectors of all countries examined are gradual (if any). This is quite expected as the transformation of industry structure is usually subject to exogenous rigidities that may require time to be smoothed out, even when the transition is rapid. In addition, the risk variables in the left-hand side of Eq. (3) may also be subject to similar dynamics, and the potential impact of stock variables on flow variables (such as the loan loss provisions) may be better approximated by a dynamic formulation (see Laeven and Majnoni, 2003).

Therefore, we augment the static models given by Eqs. (1) and (3) with lagged dependent variables as follows:

$$\theta_t = a'_0 + \delta_1 \theta_{t-1} + a'_1 ref_t + a'_3 x_{it} + a'_4 m_t + u'_{it} \quad (4)$$

$$r_{it} = b'_0 + \delta_2 r_{it-1} + b'_1 \theta_t + b'_2 \theta_{t-1} + b'_3 der_t + b'_4 x_{it} + b'_5 m_t + \varepsilon'_{it} \quad (5)$$

A value of  $\delta$ s between 0 and 1 implies that the dependent variables of the above equations persist, but they will eventually return to their normal (average) level. Values close to 0 mean that the speed of adjustment is high, while values close to 1 imply very slow adjustment.<sup>12</sup>

The choice of the estimation procedure rests on the special features of each empirical model. Estimation of Eqs. (1) and (3) is carried out using panel data instrumental variables regression. The main reason behind this choice is that in the special CEE case, it may be possible that after deregulation started, and taking into account the huge transformation of the economy and the society of these countries in a small period, risk increased significantly, which led to increased financial

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<sup>12</sup> The coefficients on the lagged values take implausible values (e.g. negative or very small) for panels with a very small time dimension, and are highly dependent on the robustness of the estimation method (see Nerlove, 2002).



instability. The entry of foreign banks, together with the aforementioned reduction in market players may have been a significant reason in decreasing competition. To prevent our model from capturing this adverse causality we instrument against all risk and macroeconomic variables, as well as their first lags and country dummies, in Eqs. (1) and (3). As regards Eqs. (4) and (5), we use the system GMM estimator proposed by Blundell and Bond (1998). Besides accounting for the specified dynamics, this estimator has two additional virtues. First, it does not break down in the presence of unit roots (for a proof see Binder et al., 2003) and second it accommodates the possible endogeneity between the risk variables and  $\theta$  by means of appropriate instruments.<sup>13</sup>

Table 4 reports the empirical results of the estimation of Eq. (1). Two variants of the static model are presented. The first (column I) captures reform by dummy variables that correspond to the important banking laws implemented during the reform process (see Table 3), while the second (column II) employs the EBRD index of banking sector reform instead of the dummies. Contrary to standard accounts, these static models indicate that the reform process has not contributed positively to competitive conditions of the CEE banking systems. This could have been acknowledged by merely looking at the measures of  $\theta$  (Table 2) as derived by estimation of System (2), and the positive correlation with *ebrd* strengthens this conclusion. The effect of the banking-law dummies is less clear, with three of them appearing positive and statistically significant, as opposed to four being negative and significant. Therefore, in the CEE banking systems, a relationship between reform and competition may be given alternate interpretations, which in fact may not be restricted

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<sup>13</sup> To guarantee robustness we control for country heterogeneity and temporal variation in the above specifications through the appropriate use of dummy variables (see Baltagi, 2001). These dummy variables have been found jointly statistically significant in virtually all equations, but they are not reported to save space.

to economic phenomena.<sup>14</sup> This results is new in the literature and calls for a deeper institutional analysis that is, however, beyond the scope of the present paper.

[Insert Table 4 here]

As regards the rest of the explanatory variables, a notable result is the positive effect of the increased share of foreign banks. Therefore, the widely held view that sales to strategic foreign investors, as the desirable form of privatization to promote competitive conditions, does not hold in the present context. This may imply that at least in the short run, wrong types of networks may be in place, making successful restructuring much less likely. Furthermore, this effect counterbalances the reduction of market power owing to the privatization of publicly owned institutions, which is reflected in the positive correlation between  $\theta$  and *pub*. Finally, as regards the control variables, it seems that the macroeconomic environment of the period examined enhanced imperfect competition. This implies that reduced interest rates (and therefore reduced interest margins) led banks to charge prices significantly above marginal costs, probably in view of the weak Central Bank and anti-trust policies in place.<sup>15</sup>

Some of the effects discussed above may imply a special role for the dynamic framework given by Eq. (4). The results, presented in columns III and IV of Table 4, provide a somewhat different picture, since most of the coefficients on banking laws suggest a negative relationship between reform and market power. This can be viewed as the outcome of controlling for the highly persistent coefficient of the lagged dependent variable, which implies a slow adjustment to equilibrium (it takes values close to 1). Yet, we should note that the 2002 dummy remains positive and

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<sup>14</sup> Such explanations may include informational opacity, partisan politics, domestic alliances and institutional capacity.

<sup>15</sup> We estimated several different versions of the equations presented, adding or excluding some of the control variables. Changes in the results were negligible.

particularly significant. The effect of the rest of the explanatory variables remains similar but is somewhat weakened (especially as regards *invgdp*), as part of their explanatory power is also absorbed by the persistence of  $\theta$ . When we use *ebrd* instead of the banking-law dummies the picture is also modified, with the effect of reform becoming negative but insignificant. Certainly, these results imply that the dynamic specification is more apt to the theoretical predictions, however a clear cut positive relationship between banking sector reform and competition is not confirmed.

We now turn to the estimation results of Eqs. (3) and (5) that examine all the links in the RCR chain, in terms of both leverage and credit risk. The main finding of the capital equations (columns I and II of Table 5) is that in the CEE banking system, the theoretical underpinnings of Keeley (1990) and the discussion that followed are verified only concerning the relationship between competition and risk-taking behavior of banks. In this respect, our results are also similar with those of Salas and Saurina (2003), with market power being positively correlated with capital and negatively correlated with credit risk. In contrast, the moving factor of this relationship does not appear to be the reform process, at least as regards the capitalization of banks. The new capital adequacy requirements enforced brought the CEE banking environments closer to Basle standards, thus reducing the high capital adequacy ratios inherited from the old regime. Decreased capital ratios matched with the stable or decreasing competition (as estimated above) explain the suggested negative correlation between *cap* and most of the reform dummies. To perhaps take this argument a step further, the institutional reforms implemented may not be viewed in a similar context with the deregulation of developed banking industries, since the entire program in CEE countries constituted a case for efficiency (and not competition) through reform, at least during our sample period.

[Insert Table 5 here]

Yet, even if such a pattern between capital and reform can claim legitimacy, a parallel effect between credit risk and the banking laws that affect it is obviously flawed, since credit risk management is forward looking. Indeed, the relationship identified is positive as all the statistically significant coefficients on the relevant dummy variables bear a positive sign. This effect is transmitted through the negative relationship between market power (higher economic profits) and loan loss provisions, which is a typical result in the literature (see e.g. Salas and Saurina, 2003). To phrase these results differently, the RCR nexus in CEE banking may be interpreted as one between reform, competition and credit risk, and not with overall bank risk.

Turning to the rest of the explanatory variables, we note that the increasing share of foreign banks leads to increased risk aversion (negative impact of *for* on *cr*). This implies that increased foreign ownership is associated with concerns regarding the quality of loans made and possibly with superior managerial strategies on this matter. Also, larger banks are associated with higher loan loss ratios, which is quite an expected result since large banks have more diversified portfolios that could encourage more risk-taking (Hughes et al., 1996).<sup>16</sup> Finally, the macroeconomic variables are usually significant in all estimated equations and with the same signs as in the previous literature (e.g. Salas and Saurina, 2003). Of particular interest is the effect of *invgdp* in the credit risk equations, indicating that provisioning is procyclical (for similar conclusions see Laeven and Majnoni, 2003).

## 5. Conclusions

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<sup>16</sup> We do not control for bank size in the capital equations, since the pearson correlation between the natural logarithm of bank assets and the capital ratios is as high as 0.86.

In this paper, we analyzed the relationship between reform, competition and risk-taking in CEE banking, as this has important implications for the effects of convergence of European banking systems under a common regulatory umbrella. We have reviewed the theoretical and empirical literature, and showed that the mainstream argument views deregulation of the banking industry as a requisite for improved competitive conditions. Yet, this may leave bank managers with an increased incentive to take on extra risk, which in turn may increase the risk of bank failure. While this literature is seminal to the understanding of these sequential events, limited evidence is provided for transition economies, where reform rather than deregulation may be a more appropriate term in the definition of the implied threefold relationship.

We contend that the first part of relationship may represent an empirical puzzle if the focus is shifted from western-type to previously centrally-planned economies. By examining both static and dynamic empirical frameworks, a series of banking laws implemented during the 1994-2005 period, and by using a non-structural measure of competition for the first time in the study of the RCR nexus, we find no clear-cut positive relationship between banking sector reform and competition. In fact, the dynamic model seems to be better able to control for some of the transitional characteristics, but still other (possibly non-economic) factors may be at work, forcing this relationship off equilibrium. Whether this window of opportunity for contesting market power in CEE banking is transitory, it remains to be figured out in the near(?) future.

However, the absence of a trade-off between banking sector reform and market power does not hamper the competition-risk nexus as identified by previous research. Especially when we focused on credit risk, which may be considered as a leading

indicator of bank risk policy, we found that market power is negatively associated with the risk-taking behavior of banks, while the relevant banking laws exert a positive impact. Finally, some auxiliary results suggest that increased foreign ownership and the privatization of publicly-owned institutions reduce the risk-taking (in terms of credit risk) incentives of banks. At a broader level of analysis, the conclusions of the present paper underline the crucial relevance of the special features of the examined banking industries, and they highlight the need to develop more appropriate theoretical and empirical frameworks that encompass institutional characteristics of transition banking systems.

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**Table 1**  
**Descriptive statistics**

	Albania	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Serbia	Slovakia	Slovenia
<b>R</b>	65,053	98,664	112,312	204,842	47,270	62,860	36,418	57,000	43,240	186,950	66,453	65,286	75,474
<b>C</b>	69,154	88,883	99,019	182,144	39,124	52,561	26,866	50,841	37,575	181,908	52,033	57,204	78,993
<b>q</b>	1,250,249	570,526	801,410	2,176,524	299,970	592,536	401,117	464,642	372,176	999,085	709,106	513,303	707,699
<b>p</b>	0.127	0.178	0.158	0.147	0.189	0.145	0.112	0.15	0.152	0.142	0.142	0.156	0.139
<b>w</b>	0.063	0.082	0.065	0.06	0.092	0.051	0.054	0.062	0.093	0.056	0.063	0.075	0.059
<b>r</b>	0.047	0.068	0.065	0.088	0.071	0.078	0.047	0.07	0.058	0.082	0.053	0.058	0.064
<b>gdp</b>	6.45	2.175	4.441	2.8	6.275	3.85	4.475	5.85	4.516	4.05	2.791	3.6	4.45
<b>ir</b>	1.439	26.85	6.083	7.425		16.05	8.958	8.583	1.556	9.325	3.190	28.275	10.85
<b>pub</b>	65.58	31.54	23.19	35.11	50.08	16.45	29.16	54.54	40.85	32.325	53.73	68.79	32.625
<b>for</b>	48.48	67.16	49	52.475	66.65	60.525	55.29	59.38	44.78	11.51	43.74	15.4	57.52
<b>inv</b>	21.93	17.49	25.5	29.15	28.31	22.125	22.39	24.39	21.26	24.39	21.83	28.17	28.34
<b>ta</b>	1,316,947	699,003	913,947	2,769,430	329,704	661,711	435,659	513,691	410,206	1,745,472	810,592	584,891	778,997
<b>da</b>	0.724	0.747	0.76	0.698	0.742	0.761	0.688	0.709	0.682	0.708	0.75	0.725	0.733
<b>la</b>	0.399	0.434	0.435	0.405	0.424	0.44	0.378	0.456	0.457	0.432	0.439	0.423	0.415
<b>cap</b>	0.131	0.172	0.158	0.149	0.201	0.134	0.159	0.201	0.172	0.151	0.161	0.186	0.169
<b>cr</b>	0.077	0.039	0.021	0.032	0.046	0.015	0.037	0.023	0.037	0.028	0.043	0.034	0.05
<b>dep</b>	739,089	594,317	755,746	1,396,645	266,024	497,314	262,829	409,320	304,216	728,355	613,683	463,144	609,897
<b>ebrd</b>	2.216	2.841	3.208	3.366	3.575	3.75	3.233	3.025	3.233	2.708	1.466	3.042	3.175

*Note:* R: total revenue; C: total expenses; q: total earning assets; p: total revenue to total earning assets; w: total operating expenses (overheads)/total assets; r: interest expenses/total deposits and short-term funding; *gdp*: annual % GDP growth rate; *ir*: short-term interest rate; *pub*: % of publicly owned banks in terms of total industry assets; *for*: % of foreign owned banks in terms of total industry assets; *inv*: total investments/GDP; *ta*: total assets; *da*: deposits & short term funding/total assets; *la*: total loans/total assets; *cap*: total equity/total assets; *cr*: loan loss provisions/total loans; *dep*: total deposits and short-term funding; *ebrd*: EBRD index on banking reform. Figures other than ratios are expressed in thousand euros.

**Table 2**  
**Evolution of competitive conditions in the CEE banking systems ( $\theta_i$ )**

	Albania	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Serbia	Slovakia	Slovenia
<b>1994</b>	0.192	0.181	0.551	0.591	0.731	0.224	0.413	1.158	0.762	-0.044	-0.167	0.534	1.097
<b>1995</b>	0.181	0.245	0.599	0.601	0.589	0.382	0.416	0.900	0.775	-0.031	-0.083	0.498	1.005
<b>1996</b>	0.178	0.169	0.515	0.500	0.670	0.317	0.713	1.147	0.888	0.153	-0.107	0.445	0.901
<b>1997</b>	0.473	0.187	0.502	0.366	0.703	0.328	0.846	1.114	0.742	0.236	-0.117	0.396	0.970
<b>1998</b>	0.408	0.183	0.514	0.437	0.684	0.450	0.683	1.134	0.754	0.279	0.073	0.412	0.977
<b>1999</b>	0.352	0.259	0.570	0.414	0.801	0.366	0.756	1.138	0.723	0.381	0.115	0.419	1.077
<b>2000</b>	0.791	0.293	0.524	0.577	0.861	0.419	0.671	1.099	0.742	0.328	0.059	0.373	1.067
<b>2001</b>	0.897	0.349	0.537	0.369	0.887	0.377	0.629	1.134	0.742	0.236	-0.121	0.321	1.008
<b>2002</b>	0.360	0.210	0.711	0.651	0.936	0.473	0.832	1.163	0.771	0.293	-0.041	0.284	1.012
<b>2003</b>	0.544	0.347	0.807	0.653	0.853	0.482	0.773	1.101	0.800	0.382	-0.001	0.322	0.996
<b>2004</b>	0.589	0.378	0.793	0.676	0.700	0.563	0.839	1.161	0.675	0.322	-0.080	0.356	1.083
<b>2005</b>	0.610	0.340	0.813	0.617	0.646	0.549	0.830	1.107	0.636	0.293	0.035	0.287	0.991

**Table 3**  
**Important reforms in the CEE banking systems**

<b>Albania</b>	Banking law (1998); Regulation on bank's investments in the equity of commercial companies (CAP) (2001); Minimum required reserves (CAP) (2003); Regulation on credit risk management (CR) (2004)
<b>Bulgaria</b>	Banking law (1997, 1998, 1999, 2000, 2001, 2002); Non-performing loans (CR) (1997); Bank bankruptcy (CAP) (2002, 2003, 2004, 2005)
<b>Croatia</b>	Banking law (1998, 2002); Capital adequacy requirements (CAP) (2003)
<b>Czech</b>	Banking law (1994, 1995, 1996, 1997, 1998, 2001, 2002, 2003, 2004, 2005); Capital adequacy requirements (CAP) (1999, 2002); Risk management system (CR) (2002); Allowances and provisions (CR) (2002); Provisions and reserve requirements (CR) (2003, 2004)
<b>Estonia</b>	Savings and loan associations act (CR) (1999)
<b>Hungary</b>	Banking law (2001)
<b>Latvia</b>	Banking law (1997, 1998, 1999, 2001, 2002)
<b>Lithuania</b>	Banking law (1994, 2001, 2004); Methods of calculation of maximum and large exposure requirements (CAP) (1996); General provisions for the accounting and recording of specific provisions against doubtful assets in financial statements (CR) (1997); Rules for managing the loan risk database (CR) (1998); Provisions for subordinated loans (CR) (1999); Regulation for calculation of capital adequacy (CAP) (2000); Maximum and large exposure requirements (CAP) (2002); Minimum loan assessment requirements (CR) (2005)
<b>Romania</b>	Banking law (1998, 2001, 2002, 2003); Bank insolvency act (CAP) (1998); Limitation of credit risk (CR) (1999, 2002); Credit risk provisions requirements (CR) (2000, 2002); Minimum capital requirements (CAP) (2002)
<b>Serbia</b>	Banking law (2001); Basic provisions on loan administration (CR) (2002)
<b>Slovakia</b>	Banking law (2001); Capital adequacy requirements (CAP) (2000, 2002, 2004, 2005); Risk management (CR) (2004)
<b>Slovenia</b>	Banking law (1999, 2001); Large exposure requirement (CAP) (2002)

*Sources:* European Central Bank, Bank of Albania, Bulgarian National Bank, Croatian National Bank, Czech National Bank, Bank of Estonia, Central Bank of Hungary, Bank of Latvia, Bank of Lithuania, National Bank of Romania, National bank of Serbia, Bank of Slovenia, National Bank of Slovakia.

*Note:* CAP: Laws that concern capital; CR: Laws that concern credit risk.

Table 4

**Banking sector reform and competition in the CEE banking systems (dep. variable:  $\theta$ )**

	Static models (Eq. 1)				Dynamic models (Eq. 4)			
	I		II		III		IV	
	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.
<b>lagged dep.</b>					0.796	18.23***	0.801	19.64***
<b>ebrd</b>			0.031	3.63***			-0.012	-1.23
<b>lawb1994</b>	0.054	1.45			0.005	0.21		
<b>lawb1995</b>	-0.025	-0.76			-0.048	-1.82*		
<b>lawb1996</b>	-0.074	-2.71***			-0.010	-0.38		
<b>lawb1997</b>	-0.059	-3.61***			-0.011	-0.92		
<b>lawb1998</b>	0.015	1.55			-0.034	-4.12***		
<b>lawb1999</b>	0.090	6.63***			-0.038	-2.61***		
<b>lawb2000</b>	-0.097	-8.25***			-0.022	-2.23**		
<b>lawb2001</b>	-0.063	-9.15***			-0.071	-10.63***		
<b>lawb2002</b>	0.114	13.86***			0.124	14.90***		
<b>lawb2003</b>	0.040	3.31***			-0.059	-4.73***		
<b>lawb2004</b>	-0.007	-0.46			0.001	0.09		
<b>lawb2005</b>	0.028	1.07			-0.049	-1.66		
<b>da</b>	-0.037	-2.13**	-0.032	-2.06**	-0.064	-2.52***	-0.062	-2.44***
<b>la</b>	0.007	0.43	0.015	0.95	-0.052	-2.29**	-0.048	-2.19**
<b>for</b>	0.161	9.45***	0.161	9.28***	0.046	3.22***	0.049	3.10***
<b>pub</b>	0.119	5.43***	0.113	5.13***	0.221	2.18**	0.239	2.46***
<b>ir</b>	-0.293	-8.72***	-0.130	-3.93***	-0.235	-8.63***	-0.245	-8.12***
<b>invgdp</b>	0.795	9.64***	0.803	9.45***	0.124	1.57	0.228	1.81*
<b>cons</b>	0.273	9.19***	0.133	3.78***	0.236	8.15***	0.245	8.92***

*Note:*  $\theta$ : banking industry competition; ebrd: EBRD index on banking reform; da: deposits & short term funding/total assets; la: total loans/total assets; for: % of foreign owned banks in terms of total industry assets; pub: % of publicly owned banks in terms of total industry assets; ir: short-term interest rate; invgdp: total investments/GDP; lawb: banking law.

The \*\*\*, \*\*, and \* indicate 1 per cent, 5 per cent and 10 per cent significance levels, respectively.

**Table 5**  
**Reform, competition and risk taking of CEE banks**

	<b>I</b>		<b>II</b>		<b>III</b>		<b>IV</b>	
	<b>cap (static model) Eq. 3</b>		<b>cap (dynamic model) Eq. 5</b>		<b>cr (static model) Eq. 3</b>		<b>cr (dynamic model) Eq. 5</b>	
	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.	coef.	t-stat.
<b>lagged dep.</b>								
<b>θ</b>	0.187	3.96***	0.012	1.81*	-0.076	-2.75***	0.180	4.18***
<b>lawea1996</b>	-0.047	-2.09**	-0.042	-2.01**			-0.026	-2.79***
<b>lawea1998</b>	-0.036	-2.39**	-0.032	-2.25**				
<b>lawea1999</b>	0.012	0.95	0.029	1.63				
<b>lawea2000</b>	-0.029	-1.12	-0.034	-1.35				
<b>lawea2001</b>	-0.021	-0.84	-0.004	-0.35				
<b>lawea2002</b>	-0.022	-2.27**	-0.028	-1.91*				
<b>lawea2003</b>	-0.028	-2.38**	-0.028	-2.22**				
<b>lawea2004</b>	0.011	0.47	0.000	-0.04				
<b>lawea2005</b>	0.043	1.44	0.005	0.27				
<b>lawllp1997</b>					-0.005	-0.41	0.016	2.07**
<b>lawllp1998</b>					0.046	2.01**	0.051	2.08**
<b>lawllp1999</b>					0.007	0.32	-0.010	-0.58
<b>lawllp2000</b>					-0.019	-0.84	0.005	0.30
<b>lawllp2002</b>					-0.007	-0.71	0.013	1.87*
<b>lawllp2003</b>					0.028	1.50	0.025	1.38
<b>lawllp2004</b>					-0.014	-0.85	-0.013	-0.91
<b>lawllp2005</b>					0.061	3.22***	0.070	3.80***
<b>lnta</b>					0.009	5.22***	0.009	5.18***
<b>for</b>	-0.050	-2.92***	-0.048	-2.17**	-0.018	-1.99**	-0.019	-2.18**
<b>pub</b>	-0.009	-0.42	0.004	0.45	0.023	1.54	0.032	2.84***
<b>ir</b>	0.153	4.82***	0.173	5.08***	0.009	0.29	-0.017	-0.77
<b>invgdp</b>	-0.235	-2.38**	-0.097	-2.38**	-0.938	-2.52***	-0.091	-2.22**
<b>cons</b>	0.145	5.62***	0.529	15.31***	0.162	5.75***	0.154	5.44***

*Note:* cap: total equity/total assets; cr: loan loss provisions/total loans;  $\theta$ : banking industry competition; lawea: laws affecting capital risk; lawllp: laws affecting credit risk; lnta:  $\ln(\text{total assets})$ ; for: % of foreign owned banks in terms of total industry assets; pub: % of publicly owned banks in terms of total industry assets; ir: short-term interest rate; invgdp: total investments/GDP. The \*\*\*, \*\*, and \* indicate 1 per cent, 5 per cent and 10 per cent significance levels, respectively.